



In the United States Patent and Trademark Office

Appn. No. 09/225,616  
Appn. Filed: 01/05/99  
Applicants Zhijiang Wang, Alice Z. Gheen and Ying Wang  
Appn. Title High Power High Efficiency Cladding Pumping Fiber Laser  
Examiner/GAU

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Information Disclosure Statement

Commissioner of Patents and Trademarks  
Washington, District of Columbia 20231

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TECHNOLOGY CENTER 2800

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.  
Following are comments on these references pursuant to Rule 98:

Snitzer et al. shows apparatus for coupling radiation into a single-mode core of an optical fiber laser..

Muendel shows an optical fiber structure for efficient use of pump power.

Endriz shows a diode laser source with concurrently driven light emitting segments.

Endriz (5,793,783) shows a method for producing high power beam from a diode laser source having one array or plural subarrays.

Huang shows a lentslet module for coupling two-dimensional laser array systems.

Endriz (5,594,752) shows a diode laser source with concurrently driven light emitting segments.

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Head et al shows an apparatus for coupling a multiple emitter laser diode to a multimode optical fiber.

Hardy, Jr. et al shows a method and apparatus for concentrating the energy of laser diode beams.

Legar et al shows method and apparatus for efficient concentration of light from laser diode arrays.

Fan et al shows a multiple-laser pump optical system.

Field et al shows apparatus and method for longitudinal diode bar pumping of solid state lasers.

Sprague et al shows multi-beam optical system using lens array.

Muendel et al discussed 35-watt CW singlemode ytterbium fiber laser.

In the present invention, cladding boundary geometry structures that can prevent the formation of local modes are disclosed. Besides the cladding geometry, methods for efficient coupling of diode lasers into a laser fiber for high power injection are also disclosed. Essentially, the new methods make it possible to transmit diode laser beams for a long distance with substantially the same brightness. In other words, with the methods and apparatus disclosed, a laser beam from a laser diode array with collimating structures can be transmitted for a long distance while the beam spot dimension including beam divergence can be kept substantially unchanged even if the beam from said array is not substantially collimated. With the method taught in the present invention, laser diode array modules can be formed with laser diode arrays (LDA) with collimating structures and relay systems. Because of the brightness conservation nature of the modules, when a plurality of such modules (such as 3, 9, or more than 200 pieces) are combined, the beams from the arrays can be efficiently coupled into an optical fiber. Thus the pumping laser coupling method can be used for the construction of high-efficiency and high-power fiber lasers. Thus, the fiber lasers of this invention may comprise of a fiber laser core doped with active species, a symmetry-broken inner cladding or a multiple-imaging inner cladding surrounding said core, a plurality of brightness substantially-conserved laser diode array module for coupling the beam from said laser diode array module into said inner cladding.

None of the references described above have the features described in the present invention as recited in claims 1 to 18.

Very Respectfully,

A handwritten signature in black ink, appearing to read "Zhijiang Wang". The signature is fluid and cursive, with the first name "Zhijiang" and the last name "Wang" clearly distinguishable.

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